Section 4 Socioeconomic Characteristics of the Planning

SECTION 4
SOCIOECONOMIC CHARACTERISTICS OF THE PLANNING AREA

A. Purpose

The purpose of this chapter is to forecast future wastewater flows and the distribution of flows within the planning area. In order to determine future flows, existing land-use patterns are reviewed, current and future land-use policies for future development are presented, and population forecasts for the planning area are set forth. Consideration is given to those trends and factors which affect and substantiate the forecasts.

B. Existing Land Use

The City of Mount Sterling is arranged in the typical spoke and wheel type arrangement with the central downtown area as the hub and Maysville and Camargo Roads dissecting the city into eastern and western half and Highway 60 and Spencer Road dissecting the northern and southern half. Indian Mound Road circles the central business district. The districts are Northeast, Southeast, Southwest and Northwest with the Central Business District as the hub. The older sections of the city, generally in the central business district were constructed in rectangular grid patterns. As one moves away from the central business district, the main roads move away in a spoke like pattern.

New residential growth has occurred in all four quadrants of the planning area. The southwest and northeast quadrants have experienced the most growth due to increased access with the construction of the Mt. Sterling bypass. All of the newly developed areas have been recommended

1. Central Business District

Multi-family developments are located in the downtown area along with some single-family residences. These structures are generally wood construction built between 1900 and 1930.

2. Southwestern Quadrant

The southwestern quadrant of the planning area has experienced the most residential growth. This area has ample access from U.S. 60 (Winchester Road), Prewitt Pike, Fogg Pike and KY HWY 11. None of this area is currently served with sanitary sewers.

3. Southeastern Quadrant

The southeastern quadrant is mostly farmland and has not seen significant residential or commercial development.

4. Northeastern Quadrant

The northeastern quadrant has seen sporadic residential development and industrial growth due to the location of the industrial park.

5. Northwestern Quadrant

The northwestern quadrant has some newer development around the previous Old Silo golf course area. The Kentucky Highway Department has improved Maysville Road and this along with the ease of access to the I-64 should spur growth in this area in the future.

C. Economic Base and Development Potential

Mt. Sterling has historically served as a farm marketing center for the surrounding multi-county region. Mt. Sterling still functions as a trade center for a variety of agriculture products. Many of the retail, wholesale and service businesses in Mt. Sterling depend on the agricultural economy of the region for their continued growth.

Residential uses occupy the majority of land in the planning area. The future need for more residential land will depend on the availability of sewers. Where sewers are available, the average density of houses is 4 per acre. The density will decrease if sewers are not available.

Commercial land use will increase as the population of the planning area increases and as the need for an expanding regional market increases. Based upon the Mt. Sterling Planning Commission's 2015 Comprehensive Plan, commercial acreage in the planning area is projected to grow in the northern sections of the planning area due to the amount of vacant commercial-type property remaining, the interstate interchanges and high traffic volumes.

Commercial development is anticipated at four quadrants of the 1-64 and U.S. 460 Interchange and at three quadrants of the 1-64 and U.S. 60 interchange. Other areas of commercial expansion are in the northwest section of the by-pass, at the western section of the by-pass between KY 713 and U.S. 60, on the southwest corner of the intersection of U.S. 460 and the bypass, at two locations on the southeast section of the bypass, and on the eastern sides of the intersection of the bypass and KY 647. In addition, commercial development is anticipated adjacent to the Gateway Shopping Center and the Windsor Shopping Center.

During the 1960's the economic base of Mt. Sterling shifted from agriculture to manufacturing. Today Mt. Sterling functions as the Industrial and commercial center for the surrounding seven-county labor market. This trend is expected to continue due to the recent development of major automobile assembly plants and their suppliers in Central Kentucky.

The 2015 Comprehensive Plan estimated future land needs for the residential, commercial and industrial classifications. This report will use population estimates and forecasts to estimate future residential growth and include the estimated future commercial and industrial growth using information used to develop the comprehensive plan along with local planning officials.

D. Population Trends and Forecasts

For the past 100 years, the Mount Sterling - Montgomery County area has been one of the fastest growing areas in Kentucky. The 2010 Census of Population established a population of 6,902 for the City of Mount Sterling and 26,499 for Montgomery County. Data reported by the US Census Bureau in from July 1, 2010, shows that the populations of Mount Sterling and Montgomery County for 2020 will be 7,663 and 29,421, respectively. Census figures from 1900 to 2010 shown in Table 4-1 illustrate the growth in Mount Sterling - Montgomery County.

TABLE 4-1
POPULATION BY CENSUS RECORDS

YEAR	CITY OF MOUNT STERLING	PLANNING AREA	MONTGOMERY COUNTY
1900	2,777	5,426	12,834
1910	2,785	5,440	12,868
1920	2,656	5,189	12,245
1930	2,535	4,952	11,660
1940	2,677	5,230	12,280
1950	2,850	5,568	13,025
1960	2,949	5,761	13,461
1970	3,435	6,710	15,364
1980	4,940	9,650	20,046
1990	4,823	9,422	19,561
2000	5,695	11,125	22,554
2010	6,902	13,483	26,499
2020 (1)	7,663	14,970	29,421

(1) 2020 population estimates for Mount Sterling and Montgomery County were made by the University of Louisville Kentucky State Data Center.

From 1920 to 1940 growth in Mount Sterling - Montgomery County declined slightly. This trend is likely due to service men leaving for deployment in World War I and II. Gold Star Casualty Searches revealed that 10 Montgomery County residents died in WWI and 33 died in WWII. Another declining period was between 1980 and 1990, likely due to a downturn in the economy causing a slight exodus to larger cities for employment opportunities.

Population forecasts for Kentucky from 2010-2040 have been made by the Kentucky State Data Center, Population Research, University of Louisville. No projections for cities are available so this data must be interpolated from the county data. The planning area population projections are calculated on the basis that 60 percent (actual percentage of total growth 2010-2020 for Montgomery County) of the growth for Montgomery County will occur in the Mount Sterling planning area because of the availability of municipal services, such as police and fire protection, and utilities.

TABLE 4-2
POPULATION PROJECTIONS

YEAR	CITY OF MOUNT STERLING	PLANNING AREA	MONTGOMERY COUNTY
2010	6,902	13,483	26,499
2015	7,191	14,047	27,608
2020	7,663	14,970	29,421
2025	8,137	15,896	31,241
2030	8,609	16,817	33,051
2035	9,067	17,712	34,810
2040	9,525	18,608	36,571

The population for 2010 is derived directly from census data. The projections for Mount Sterling for the years 2020 through 2040, the beginning and end of the 20-year planning period are taken directly from the Kentucky State Data Center Forecasts. The balance of the projected population figures for Montgomery County and the planning area are interpolated using the growth projections for the city. The Data Center and the Mount Sterling Chamber of Commerce forecasts also estimate that there will be 2.64 people living in each house on average for the county.

E. Future Land Use Development Plan

1. 2015 Comprehensive Plan

The City of Mount Sterling has an existing comprehensive plan which was prepared in April 2015, by the Mount Sterling Planning and Zoning Commission. The following paragraphs concerning land use and emphasizing the need for municipal sewer service are excerpted from the plan:

a. Residential Land Use

"Residential uses in the planning area occupy 6,270 acres. The majority of the lands in the Urban Service Area are proposed for future residential use." (2015 Comprehensive Plan)

Population estimates show that there will be an additional 3,630 people living in the planning area by 2040. Using 2.64 people per household results in an additional 1,375 houses that will need to be built over the next 20 years. ***If you assume 4 houses per acre, the required land area will be approximately 344 acres.***

b. Commercial Land Use

"The planning area has 250 acres used for commercial purposes in 2003. Of this figure approximately 150 acres is in the shopping center type of commercial development. This exemplifies the regional commercial importance that the area is experiencing. Approximately 75 additional acres will be needed by the year 2020 according to present ratios, which project a continuation of the high square foot per capita ratios that currently exist. However, as the population of the County, and planning area experiences the increases that are projected, commercial expansion will be necessary to maintain a satisfactory balance in the community and to continue to attract the regional market." (2015 Comprehensive Plan)

c. Industrial Land Use

"It is assumed and projected that the Mount Sterling planning area will continue to be the industrial center of Montgomery and adjacent counties. The projected population of the County is used to determine present ratios and for future projections of need." (2015 Comprehensive Plan)

Generally accepted standards for total gross land requirements for all types of industry are 12 acres per 1,000 persons.

Mount Sterling and Montgomery County has enough acreage set aside for industrial use until well after the tum of the century. However, due to the regional role played by the City, its geographic location and 2 interchanges on I-64, and the recent development of major automobile assembly plants and their suppliers in Kentucky, it is conceivable that a major manufacturing and assembly concern needing 100-300 acres may elect to locate along the I-64 corridor. The current need derived from comparison to other communities and national standards decreased from 240 acres to 140 acres in 1992. The plan for industrial use herein recommended is for future industries to locate in existing buildings and industrial parks.

However, because there are presently no land use controls outside the corporate limits, there are only "hidden controls" effecting industrial location: water, sewer, urban services needed for new industry, and the use of local incentives. It is recommended that some zoning or private restrictions be applied to the planning area that would be understood by industry and would protect and help recover the public investment in the industrial parks. The Industrial Development Foundation, which is responsible for the acquisition, development, and sale of the industrial properties that it owns, fulfills this need for development standards.

It is recommended to relocate some of the industrial uses along Hinkston Creek and in the C.B.D. to more desirable locations. Such relocation will not affect acreage totals to any great extent, especially if the industrial parks are annexed.

Some increase in industrial acreage is anticipated, as all industries will not elect to move to vacant industrial lots in the industrial parks. A projected increase of ten acres per decade should accommodate the new and possibly relocating industries. However, it is again noted that this projected land needs do not recognize the possibility of a large manufacturing concern.

Industrial investment in the Mount Sterling planning area is recommended to be located in existing industrial areas and facilities served by KY 11 and in the two industrial parks and areas located on the northwest and southwest quadrants of the U.S. 60 interchange of I-64 as designated on the Land Use Plan Map."

Using the standard identified in the Comprehensive plan of 12 acres per 1,000 people and a 2040 projected population in Montgomery county of 36,571 people, the total acreage required for industrial use should be approximately 439. The current industrial park is approximately 493 acres with 130 acres still available.

F. Socioeconomic Conditions

1. Employment in the Planning Area

"The economies of Mount Sterling, the planning area, the County, the Area Development District and the Labor Market Area are generally interrelated. The closest relationships are found between the smaller planning areas and in the relationships between the city and the county.

The Labor Market Area extends from Montgomery County into Bourbon, Nicholas, Bath, Menifee, Powell, and Clark Counties. The following table presents Labor Force Characteristics of Residents of Montgomery County and the Labor Market Area, and the Estimated Labor Supply from 1979-2001." (2015 Comprehensive Plan)

TABLE 4-3
LABOR FORCE CHARACTERISTICS
Total Available Labor- 2000

AREA	TOTAL POTENTIAL EMPLOYEES	UNEMPLOYED	POTENTIAL LABOR	UNDEREMPLOYED	FUTURE LABOR
Labor Market Area	18,129	3,142	2,424	12,563	10,136
Montgomery County	3,635	517	253	2,865	1,547

Source: US. Department of Labor; Bureau of Labor Statistics; KY Cabinet for Economic Development.

Notes: Total Available Labor = Unemployed+ Potential Supply+ Underemployed.
Unemployed - people currently not employed but actively seeking work.
Potential Labor - people not in the labor force, but work of jobs were available.
Underemployment - people employed in wholesale/retail trade and non-professional jobs. Future Labor - people becoming 18 years of age 2002 - 2006.

2. Major Employers in the planning Area

a. Industrial Growth

There are several major industries in the Mount Sterling Planning Area that provide employment opportunities. Listed below are some of the major industries that employ over 100 people. Growth in the planning area is limited to undeveloped land. As stated previously, there are approximately

130 acres of undeveloped land in the industrial park. It is difficult to determine what type of industry could develop this land and therefore it is difficult to determine job growth. We will use an estimate of flow generated per acre per day to determine flows and loadings anticipated from this undeveloped land.

TABLE 4-4
MAJOR EMPLOYERS IN THE PLANNING AREA

INDUSTRY NAME	NUMBER OF EMPLOYEES
Affinity Apparel	57
American Highway Fencing	4
Big Rapids Products	68
C & C Industrial	15
CKCS / Welch Packaging	30
Cooper Standard	529
Custom Machining	9
Eastern Electroplating	7
Fibreform Containers	21
Gateway Manufacturing	40
Gateway Tool & Die	6
Grief	65
Kyosan Denso Mfg.	851
Masco Cabinetry	379
Nestle USA (Cold Storage)	51
Nestle USA	1151
Olympic Steel	70
Precision Resources	134
Rogers Foam	120
RS Technical Services	15
Ruth Hunt Candy	20
Sterling Manufacturing	8
Summit Polymers	176
The Walker Company	210
The Wells Group	10
Trojan	6
Vogelsang	37

Although theoretically sufficient acreage is available for industrial expansion, there may occur an instance where a large manufacturing company needing 250 to 500 or more acres may be interested in locating along either side of I-64. This area is highly desirable for industrial development due to visibility and access from I-64, the availability of utilities, the possibility of incentives and financing, and the provisions of city services. For this report, we will allocate an additional 500 acres for future industrial growth along with the existing 130 acres for a total of 630 acres.

b. Commercial Growth

> "The Land Use Plan Map designates areas for future commercial expansion. Commercial development is anticipated at four quadrants of the I-64-U.S. 460 interchange and at three quadrants of the I-64-U.S. 60 interchange. Other areas of commercial expansion are: the northwest section of the by-pass, at the western section of the bypass between KY 713 and U.S. 60; the southwest comer of the intersection of U.S. 460 and the by-pass at two locations on the southeast section of the by-pass and on the eastern sides of the intersection of the by-pass and KY 647. In addition, commercial development is anticipated adjacent to the Gateway Shopping Center and the Windsor Shopping Center." (2015 Comprehensive Plan)

According to the Comprehensive Plan an additional 150 acres of commercial land will be needed and developed by the year 2040.

G. Economic and Social Impact to the Community

A properly operated and maintained wastewater collection, conveyance and treatment system with available capacity to meet future growth patterns within a community is vital to support industrial expansion and development needs. Along with the recently developed 2015 Comprehensive Plan, this Regional Facilities Plan establishes a foundation for future industrial and residential growth. This growth will in turn lead to improved socioeconomic conditions.

Section 5 Existing Environment in the Planning Area

SECTION 5
EXISTING ENVIRONMENT IN THE PLANNING AREA

A. Physiographical Region

The Mt. Sterling planning Area is located at the western edge of the Outer Blue Grass Physiographic subregion, which is a subdivision of the much larger 43 county Blue Grass Region. The Cincinnati Arch represents the major structural feature of the Blue Grass Region. As one travels east from Lexington, cognizance is taken of the gently rolling broad upland area which is characteristic of the Inner Blue Grass subregion.

Between Winchester and Mt. Sterling the physiography changes to steeply sloped ridges and valleys which are characteristic of the easily weathered formations of the Eden Shale Belt. The deep valleys and steep slopes of the Somerset Creek Watershed area in western Montgomery County are a typical representation of this Eden group. Approaching Mt. Sterling, the ridges and valleys flatten to gently then moderately rolling uplands (except along major streams, where dissection leaves steep and rugged slopes), characteristic of the Outer Blue Grass Sub-Region and the prominent feature of the Mt. Sterling planning area. Immediately to the east of the planning area the rough, steep and heavily rolling physiography of the Knobs subregion begins. The characteristics of the Knobs can be seen in the southeastern part of Montgomery County, extending northeasterly along a line toward Owingsville.

B. Geology

The purpose here is to describe the latest or upper rock formations which are most important in considering the implications affecting the above conditions and processes. The first layer of rock below the soils is generally referred to as the “cap rock.” The dominant cap rock underlying the planning area is the Maysville group, together with smaller concentrations of the Richmond group and the Eden group. These three rock groups are consolidated sedimentary rock formed during the Upper Ordovician age (between 450 and 425 million years ago), originating from deposits of marine sediments from the inland sea that covered Kentucky at that time.

The Maysville rock group underlies nearly all of those portions of Hinkston Creek, Harpers Creek and Salt Well Branch watersheds, and a major portion of the Spencer Creek watershed, which fall within the Planning Area. The “cap rock” portion of the Maysville group (the McMillan Formation) is composed primarily of alternating layers of clay imbedded limestone and shale in the upper part and thin bedded, fossil limestone with thin shale partings in the lower part. The McMillan Formation rages from 62 to 150 feet in depth underlaid by the Fairview Formation which ranges from 110 to 125 feet in depth.

The Richmond rock group penetrates into the southwestern Spencer Creek watershed portion of the planning area generally along the divide between the Hinkston Creek and Spencer Creek Watersheds. The Elkham and Whitewater Formations make up the "cap rock" of the Richmond group having a depth of about 65 feet. The Richmond group "cap rock" is composed of thick layers of shale interbedded with thin layers of limestone. The limestone and shale layers alternate on a localized basis in the project area.

The Eden shale group underlies most of the soils in the Somerset Creek watershed portion of the planning area. The "cap rock" portion of the Eden group is basically the Garrard Formation which is between 25 and 50 feet in thickness. This "cap rock" is composed of lumpy, calcareous shale, gray to bluish-gray in color, with interlayered beds of thin limestone. The blue-gray color contributes to the use of a localized term "blue stone."

The Kentucky River and West Hickman fault system has had a substantial effect in shaping the present topography and direction of stream flows in Montgomery County. A northeasterly directed section of the fault system (locally known as the Dry Fork Fault) creates the watershed divide between Somerset Creek and Hinkston Creek in the County. The fault is primarily responsible for the uplifting and ruggedness of the Eden shale belt and the dropping of the Maysville northwest-southeast oriented fault, which is part of the same system (locally known as the Levee Fault), crosses the southern portion of the county creating the divide between the Licking River watershed and the Kentucky River watershed. Generally speaking, depth to bedrock is between 3 to 6 feet in the planning area. It is expected to that rock will be encountered during construction of waste water facilities.

C. Soils

The soils of the Mount Sterling planning area are of the gray-brown Podzolic group formed from the limestone and calcareous shale that make up the bedrock formations of this Outer Blue Grass subregion. Dominant soils within the planning area are of the Lowell- Shelbyville association. Related soils found intensively in this association and within the planning area are Nicholson soils on the upper ridges and Faywood soils on the lower side slopes of valley areas.

In general, the Lowell and Shelbyville soils of the Hinkston Creek watershed area are deep, well drained and are well suited to general farming. Limitations to non-farming uses are evident due to localized concentrations of high clay content horizons in the soils which limits the effective use of septic tanks.

The watersheds adjacent to Hinkston Creek within the planning area display a moderately heavy to rugged topography with higher clay content. Shelbyville and

Nicholson Soils are on the ridgetops and Lowell soils on the valley side slopes, grading into Faywood soils on the steeper lower ridge side slope areas. These areas pose substantial non-farming uses because of topography and high clay content.

D. Topography, Slope and Watershed Boundaries

1. Hinkston Creek Watershed

The Hinkson Creek watershed area grades form a light to moderately heavy rolling topography on the west side of North Maysville Street (U.S. 460 and KY 11) to a moderately heavy to heavily rolling and steeply sloping topography to the east of Maysville Street, with characteristic rugged and very steep slopes along Hinkston Creek and its tributaries. Limestone and shale rock outcroppings of the Maysville group are prominent along stream and road cuts. Elevation variations range from a high of 1,084 feet located near the watershed boundary north of Grassy Lick Road, to a low of 896 feet at the downstream end of the watershed next to Hinkston Pike, north of I-64.

The area north of I-64 displays some of the most rugged and steeply sloped topography in the planning area. For the most part, this portion of the North Hinkston Creek Watershed is uniformly rugged with heavily sloping ridges. Discharge north of the wastewater treatment plant must be pumped in a southward direction to the existing wastewater treatment plant.

The topography on the west side of Hinkston Creek can be described as gently to moderately rolling. The topography on the east side of Hinkston Creek is more rugged, ranging from moderate to heavily rolling. Prominent ledges of outcropped rock and very steep slopes and bluffs are characteristic of the stream valleys in the upper reaches of both branches of Hinkston Creek, leveling out to a gently rolling broad valley as the branches come together.

2. Somerset Creek Watershed

Somerset Creek flows north through the western part of the planning area connecting with Grassy Lick Creek and then Hinkston Creek further downstream at a point north of Mount Sterling near the Montgomery-Bath County line. The watershed lands within the planning area can be described as a typical Eden Shale area with very steep, narrow ridges and valleys. Somerset Creek has cut deep and irregular valleys throughout the area with outcroppings of crumbling shale, sandstone and siltstone.

Elevations range from about 1,070 feet at the ridge tops near the southernmost (upstream) boundary of the watershed to a low of about 880 feet where the creek crosses under I-64 near the pipeline crossing. Due to the topography in this area, discharges in this watershed must be pumped to the existing wastewater treatment plant.

3. Spencer Creek Watershed

The Spencer Creek watershed is made up of Spencer Creek and its tributary, Sledd Creek, which joins Spencer near the intersection of KY 713 and KY 646. The Spencer Creek fork drains away from the Hinkston Creek watershed into Slate Creek in southeastern Montgomery County.

The Spencer Creek watershed displays a varying moderately heavy to heavily rolling topography with high ridges and very steeply sloped valleys along the stream beds. Thick limestone outcropping is readily apparent along the ridges of the stream valleys. The elevation high for the Spencer Creek fork is about 1,027 feet, located at the watershed boundary near the eastern city limits and KY 713. The high elevation for the Sledd Creek fork is about 1,050 feet located at the southwest tip of the watershed line. The low elevation of 835 feet for both forks is located at the confluences of the Spencer and Sledd Creek forks. Discharges in this area must be pumped to the existing wastewater treatment plant.

4. Harper's Creek Watershed

Harper's Creek drains in a southeasterly direction into Slate Creek away from the Hinkston Creek watershed, grading from a moderately heavy to heavily rolling topography in the planning area headwater to a very heavily rolling and rugged topography just outside the planning area. The valleys along the stream bed are heavily sloped and substantial limestone outcropping is apparent. The highest elevation is approximately 1,020 feet located at the watershed line and Osborne Pike and the low is about 900 feet located in the creek valley at the eastern edge of the planning area.

5. Howards Mill Watershed

The Howards Mill Branch watershed takes in a small portion of the planning area in the northeastern portion of the planning area south of I-64 near Ewington. This stream flows in a southeasterly direction and connects with Slate rolling with steeply sloped stream valleys and ridges, displaying layered limestone outcroppings. Elevations vary from a high of about 1,030 feet at the watershed divide at U.S. 60 to a low of about 940 feet along the bottom of the stream valley at Howards Mill Road. Discharges in this area must be pumped to the existing wastewater treatment plant.

6. Stepstone Creek Watershed

Stepstone Creek flows in a northeasterly direction within the planning area connecting with Slate Creek further to the east. The topography within the planning area is uniformly heavily rolling with a portion of the higher ridge plateaus serving as the road bed for I-64. The creek valley is characteristically narrow and steeply sloped with layered limestone outcroppings. Elevations vary from about 1,030 feet at the western watershed boundary to a low of about 960 feet near the stream valley bottom at the eastern edge of the planning area. Discharges in this area must be pumped to the existing wastewater treatment plant.

7. Salt Well Branch Watershed

The Salt Well Branch flows in a northeasterly direction connecting with Slate Creek in Bath County. A small portion of land within the planning area could be considered a moderately rolling plateau with the remaining portion extremely rough and made up of heavily sloped ridges leading down to the stream bed. Topography elevations on the plateau reach a high of 1,016 feet at the intersection of U.S. 60 and I-64, to a low of about 950 feet near the bottom of the stream valley at the eastern edge of the planning area. Discharges in this area must be pumped to the existing wastewater treatment plant.

E. Climate and Precipitation

1. Historical

The climate of the Mount Sterling planning area is a humid continental type with large contrasts between winter and summer temperatures. The mean average temperature is 54.9° (30-year period). The mean average monthly precipitation amounts to 3.98 inches per month. There are approximately 129 precipitation days (mean number of days with 0.01 inches of rain or more).

2. Variations

TABLE 5-1
ANNUAL AVERAGE TEMPERATURE AND PRECIPITATION

MONTH	TEMPERATURE (^{O}F)	PRECIPITATION (IN.)
January	30.80	2.86
February	34.80	3.21
March	45.30	4.40
April	54.80	3.88
May	64.00	4.47
June	72.20	3.66
July	75.80	5.00
August	74.70	3.93
September	68.20	3.20
October	56.70	2.57
November	46.00	3.39
December	35.90	3.98
Annual	54.90	44.55

Source: http://www.agwx.ca.uky.edu

F. Ground and Surface Water

1. Ground Water

The amount of ground water supplies in the planning area varies substantially with the type of rock formation, or aquifer, from which the ground water is obtained. In general, the most favorable location for obtaining large quantities of ground water exists where there are thick beds of limestone containing little or no shale located at or below stream level. Such is not the case in the Mt. Sterling planning area. The bedrock of the planning area consists of alternating and relatively thin beds of limestone and shale occurring at relatively shallow depths. The Maysville, Richmond, and Eden rock formations are notably poor ground water aquifers.

Maysville formation aquifers normally produce water yields of 100 to 500 gallons per day from drilled wells in the Hinkston Creek valley bottom and lesser amounts in other smaller valley bottoms and gently rolling upland areas where thicker limestone beds were found. The limestone beds along streams tend to yield water to small springs along the valley bottoms and hillsides.

Wells in the Richmond formation produce yields in excess of 500 gallons per day in the valley bottoms of the major stream's beds in the southern portion of the planning area but practically no water on hillside and ridge areas. Yields of between 100 and 500 gallons per day are found in wells located along smaller stream beds in the upland area.

Eden formation producing wells located along the Somerset Creek valley bottom yield 100 to 500 gallons per day but almost no water from hillside and ridge top locations.

The water from all these formations is in general very hard and yields are insufficient to meet public municipal water supply needs. Accordingly, Mt. Sterling receives its municipal water supply from surface water reservoirs.

2. Surface Water

A general description of the streams in the planning area has been covered in the section dealing with topography and watersheds. There are no gaging stations on any of the stream segments within the planning area. Thus, no stream flow and stream quality data are available other than the water quality information on the Mt. Sterling water supply reservoir, Greenbriar Reservoir, is physically located outside of the planning area.

G. Flora and Fauna Inventory Analysis

The planning area was once clothed in forest cover, most of which has been cleared by early timber cutting activity and more recently by agricultural activity. Agricultural activity coupled with heavily sloped land tends to generate considerable siltation of the streams in the planning area.

Steam sampling locations upstream from the wastewater treatment plant contain a diverse assemblage of aquatic invertebrates. Several forms which are generally associated with good water quality, including stone flies, mayflies, caddisflies, crane flies, and riffle beetles have been found. Species Diversity Index computations indicate that the stream supports invertebrate communities equivalent to those in other high-quality streams in the Blue Grass Region of Kentucky.

A total of eight species of fish were collected upstream from the wastewater treatment plant. On the whole, the fish fauna of these three locations point to fairly good water quality.

There were no unique or vulnerable plant communities found in the immediate stream area. No endangered plant species were found, nor were any records of such found in the literature search.

H. Unique Environmental, Archaeological, Historical, Scientific and Cultural Areas and Facilities

No unique places, facilities, or areas are known to exist in the Mt. Sterling planning area which will be adversely affected in any way by primary or secondary development caused by the expansion of existing or the development of new wastewater treatment system facilities.

No known endangered wildlife or plant life communities were found and none are known to exist based on a brief search for historical data of the Mt. Sterling planning area. Indian burial grounds are known to exist in the planning area which may require specialized consideration when and if found during any primary or secondary construction processes.

I. Environmental Suitability

The environmental suitability of each watershed is described briefly below. The environmental suitability is based upon general topographic conditions.

1. North-East Group of Sub-Watersheds

This group of sub-watersheds include Harpers Creek, Howard Mills Branch, Stepstone Creek, and Salt Well Branch and is located in the north easternmost section of the Planning Area.

The topography of these watersheds within the planning area is heavily rolling and is not prohibitive for development. Drainage in this watershed is to the east and must be pumped west to the Hinkston Creek watershed.

2. North of Interstate I-64

The land area north of Interstate I-64 is rapidly developing. The Woodland and Midland Trail Industrial Park, new motels and service stations as well as residential development are under various stages of construction at this time.

3. Spencer Creek Watershed

The Spencer Creek area is relatively undeveloped at present because the area drains away from the Hinkston Creek Sewer service area into Slate Creek, making it difficult to sewer.

4. Hinkston Creek Watershed

Present development is well defined in the Hinkston Creek watershed. Advantages for development in this watershed include the fact that most of the land can be serviced with gravity flow. Because this area can be serviced by gravity flow development can be serviced in a more cost-effective manner.

Section 6 Existing Wastewater System

SECTION 6
EXISTING WASTEWATER SYSTEM

A. Introduction and Purpose

Mount Sterling's sewerage system consists of one wastewater treatment plant and a fairly complex wastewater collection system. The basic components of the system are:

1. Sewage Collection and Conveyance
2. Wastewater Treatment Facilities

There are complementary components and processes which affect the utilization of the basic components. They are:

1. The quality of maintenance including standard operation procedures.
2. Water inflow and infiltration (I/I) conditions.

The purpose of this chapter is to evaluate the quantitative and qualitative capacities and capabilities of the existing system. This evaluation will establish the base line set of data which will be used to determine future system needs.

B. Sewage Collection and Conveyance

1. Gravity Sewers

The City of Mount Sterling owns and operates a municipal wastewater collection and transportation system consisting of collector sewers, trunk and interceptor sewers, wastewater pumping stations and force mains. From the 201 Facilities Plan completed in 1998, it is not known exactly when the first community wastewater collection began operation in Mount Sterling. It appears to have begun with the construction of storm sewers. The storm sewers were soon subject to connections by residential sanitary sewer laterals, creating a combined system.

Prior to the mid-1970's, the predominant type of pipe used for sanitary sewer construction throughout the Mount Sterling system was vitrified clay. The exceptions were creek crossings where cast iron pipe was used, and highway and railroad crossings where cast iron pipe was used with steel cover pipe. Since the 1970's, the predominant type of pipe used for sanitary sewer construction is polyvinyl chloride (PVC). Pipe joints have evolved from mortar joints to the present day construction using rubber "O" rings. Similarly, manhole construction has evolved from brick with mortar coating inside and outside to precast concrete.

Mount Sterling and its existing wastewater system occupy portions of four major drainage basins – Somerset Creek, Hinkston Creek, Sledd Creek, and Spencer Creek. All areas of the City drain away from the central business district. Because of this topographic feature, Mount Sterling's growth, as it has radiated from the center of the City, has been one of development of the upper portions of these drainage basins. This has led to the development of separate major sewer systems in each drainage basin. These basins have been named for the streams which drain them.

Gravity sewers range in size from 6-inch through 42-inch. The existing wastewater collection system and pumping stations for Mount Sterling are shown on Exhibit 3-2.

2. Conveyance Systems

Sixteen wastewater pumping stations presently serve the Mount Sterling area. Located by quadrants, they discharge to the pump stations are:

TABLE 6-1
WASTEWATER PUMPING STATIONS

ID No.	NAME	CAPACITY	MOTOR SIZE
North West Quadrant			
NWPS1	US 460 – Maysville Road	250 gpm	34 Hp
NWPS2	Club House Lane/Silver Creek	105 gpm	10 Hp
NWPS3	Silver Lake/ Silver Creek Lake	80 gpm	20 Hp
NWPS4	Evans Drive	80 gpm	10 Hp
NWPS5	Commonwealth Drive	185 gpm	15 Hp
South West Quadrant			
SWPS1	Alliance Drive	175 gpm	5 Hp
SWPS2	Elm Tree Village/Fogg Pike	80 gpm	5 Hp
SWPS3	Woodford Drive	130 gpm	10 Hp
South East Quadrant			
SEPS1	Smith Street/ Spencer	195 gpm	10 Hp
SEPS2	Eastland	161 gpm	18 Hp
SEPS3	Deer Park/ Doe Run	100 gpm	5 Hp
SEPS4	Arlington	185 gpm	15 Hp
SEPS5	Snow Creek	55 gpm	7.5 Hp
North East Quadrant			
NEPS1	Lexington Metals/LMS	120 gpm	5 Hp
NEPS2	Little Woodland Trailer Park	95 gpm	5 Hp
NEPS3	Longwood/ Big woodlands	910 gpm	40 Hp

C. Wastewater Treatment Facilities

1. Hinkston Creek Wastewater Treatment Plant

a. General

The Hinkston Creek Wastewater Treatment Plan (WWTP) is currently designed for an average daily flow of 3.0 million gallons per day (MGD) and a peak hydraulic flow of 9.0 mgd.

Hinkston Creek plant is located 3 miles northeast of Maysville Road along Hinkston Pike. In 2000 the plant was constructed to its present capacity of 3.0 million gallons per day (mgd). Discharge of effluent is to Hinkston Creek. KPDES Permit for the Hinkston Creek wastewater treatment plant is included as Appendix A. The WWTP flow schematic is shown on Exhibit 6-1.

b. Permitted Effluent (2000 Design Conditions)

TABLE 6-2
HINKSTON CREEK WASTEWATER TREATMENT PLANT
KPDES Effluent Limits

Constituent	Limits (Monthly Average)	
	May 1 – October 31 (mg/l)	Nov. 1 – April 30 (mg/l)
$CBOD_5$	15	15
TSS	30	30
NH_3-N	4	10
PO_4	1	2
E-Coli	130, 30-day, Geometric Mean	130, 30-day, Geometric Mean
DO	7	7
Reliability Classification	Grade C	Grade C

c. Design Flow and Loading (2000 Design Conditions)

Influent Flow

Design Flow Q_{AVE} 3.0 mgd
Peak Flow Q_{PEAK} 9.0 mgd

Influent Loading

TABLE 6-3
EXISTING DESIGN INFLUENT LOADING
HINKSTON CREEK WASTEWATER TREATMENT PLANT

CONSTITUENT	AVERAGE	
	CONCENTRATION (MG/L)	LOADING (LBS/DAY)
BOD_5	215	5,379
TSS	243	6,080
NH_3-N	25	626
TP	7	175

d. Unit Process Descriptions

INFLUENT PUMPS	
Number of units	6
Capacity	1,250 gpm @ 73 ft TDH
Motor Horsepower	40
Type	Submersible centrifugal
FINE SCREENS	
Number of Units	2
Type of screen	Rotating fine screen
Hydraulic capacity, average	1.5 mgd, each
Hydraulic capacity, peak	4.5 mgd, each
Maximum upstream liquid depth	19 inches
Bar spacing	0.25 inches
Screw conveyor diameter	10 inches
Drive motor size	2 Hp
Wash system flow rate	25 gpm
Wash system pressure	3 – 15 gpm @ 60 psig

ANAEROBIC SELECTOR BASINS	
Number of Units	4
Volume at maximum water surface	0.0320 mg each, 0.129 mg total
Volume at average water surface	0.0318 mg each, 0.128 mg total
Volume at minimum water surface	0.0316 mg each, 0.127 mg total
Hydraulic Detention Time at 3 mgd	1.024 hours
Number of Mixers	4
Mixer Horsepower, each	1
ANOXIC BASINS	
Number of Units	2
Volume at maximum water surface	0.280 mg each, 0.560 mg total
Volume at average water surface	0.278 mg each, 0.555 mg total
Volume at minimum water surface	0.276 mg each, 0.551 mg total
Hydraulic Detention Time at 3 mgd	4.44 hours
Number of Mixers	2
Mixer Horsepower, each	7.5
OXIDATION DITCHES	
Number of Units	2
Volume at maximum water surface	1.460 mg each, 2.930 mg total
Volume at average water surface	1.450 mg each, 2.880 mg total
Volume at minimum water surface	1.440 mg each, 2.880 mg total
Hydraulic Detention Time at 3 mgd	23.2 hours
Solids Retention Time (SRT) at 3 mgd	25 Days
Number of aerators	2 per ditch
Aerator horsepower, each	60
Oxygen transfer rate	420 lbs. Oxygen/hour/aerator

CLARIFIERS	
Number of Units	2
Basin diameter	91 ft
Diameter between weir walls	85.67 ft
Side water depth	14.25 ft
Surface Area, each	6,504 sq ft
Basin Volume, each	0.693 mg
Design flow, each	3.0 mgd
SOR at 3 mgd with 2 clarifiers	230 gpd/sq ft
SLR at 3 mgd with 2 clarifiers	15 lbs/day/sq ft
UV DISINFECTION	
Peak Flow	12 mgd
Average Flow	3 mgd
Minimum Flow	1 mgd
Maximum Influent TSS	30 mg/L
Number of UV modules	8
Number of Lamps in each module	10
Number of Rack Assemblies	2
UV Dose	34,000 uW-s/cm^2
Transmittance	65% at 253.7 nanometers

RE-AERATION BLOWERS/DIFFUSERS	
Number of units	2
Type	Rotary
Capacity	201 SCFM
Motor	15 Hp, 1800 rpm
Blower	2373 rpm
Discharge pressure	7.2 psi
Inlet pressure	14.7 psi
Number of diffusers	68
Diameter	9 inches
Type	Fine Bubble
BELT FILTER PRESS	
Number of units	2
Type	Belt filter press
Effective Belt Width	2 meters
Maximum Design Sludge Feed Rate	200 GPM
Solids Loading Rate	750 lbs/hour/meter
Pressed Sludge Total Solids	18%
Solids Recovery	Greater than 95%
Maximum Hydraulic Capacity	80 gpm/meter
Polyester Belt Size	Upper-80” wide x 472” long
	Lower-80” wide x 769” long

POLYMER FEED SYSTEM	
Number of units	1
Type	300 Gallon Totes
POLYMER METERING PUMPS	
Number of units	2
Type	Mechanically actuated diaphragm
Capacity	110 GPH at 150 psig (3/4 Hp)
RAS PUMPS	
Number of units	4
Capacity	1,050 GPM @ 43 ft. TDH
Motor horsepower	20
Type	Horizontal centrifugal
WAS PUMPS	
Number of units	2
Capacity	225 GPM @ 70 ft. TDH
Motor horsepower	20
Type	Progressive cavity

e. Critical Design Values

- Minimum Wastewater Temperature ... 10°C

The first step in determining the overall volume of the aeration basin is to establish the minimum anticipated temperature of the wastewater. This minimum temperature value was determined from historical data provided by mswss.

- Solids Retention Time (SRT) .... 18 Days

Since the concentration of carbonaceous organic content in typical wastewater is significantly higher than the concentration of nitrogen, the design SRT must be developed based on the growth rate of nitrifying organisms. This was determined to be approximately 18 days. A factor of safety was applied to account for variations in dissolved oxygen and system pH.

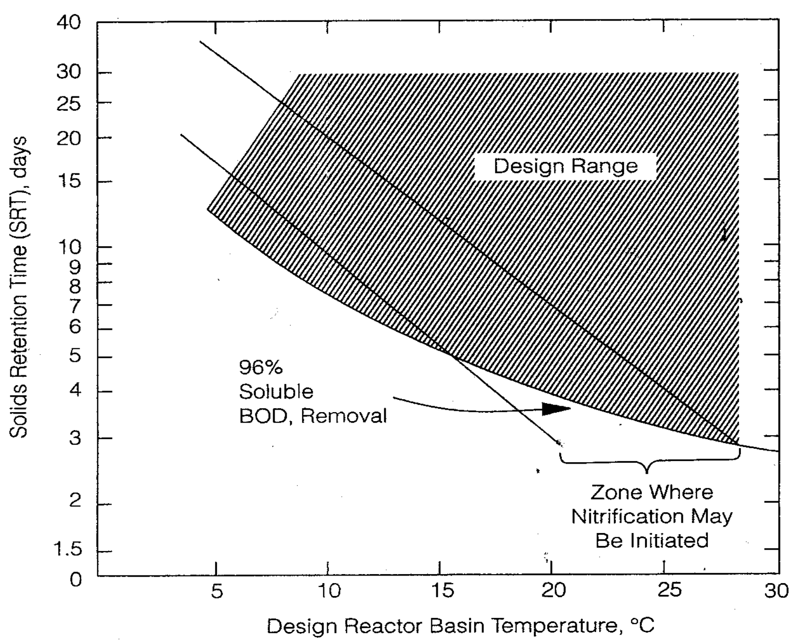

Figure 6 – 1 Design Solids Retention Time

Design Solids retention Time for Carbonaceous biochemical oxygen demand removal. *Design of Municipal Wastewater Treatment Plants, MOP 8, 4th Edition, 1998.*

f. Unit Process Descriptions

i. Influent Pumping

The influent pump station is designed to operate as two independent pump stations or as one common basin. The firm capacity of the station equals 9.0 mgd with one of the duty pumps out of service and 10.8 mgd with all six pumps running.

ii. Screening

The influent pump station discharges to two mechanically operated fine screens each with a FIRM capacity of 4.5 mgd. The material removed by the screens is then washed, compacted and discharged to roll-off containers for disposal by landfilling.

iii. Biological Treatment

The screened wastewater is discharged to a carrousel type oxidation ditch activated sludge process for biological treatment. Upstream of the two oxidation ditches are anaerobic selector basins designed to provide enhanced biological phosphorus removal (EBPR) by promoting the growth of phosphorus accumulating microorganisms. Chemical phosphorus removal facilities are provided as a backup to the EBPR process. Anoxic zones are provided to achieve denitrification. Carbonaceous BOD removal and nitrification occur in the oxidation ditches.

iv. Final Clarification

Following the biological system are two clarifiers sized to treat the peak flow and loading. Aluminum sulfate can be introduced prior to the clarifiers as needed for chemical phosphorus removal and enhanced settling. A portion of the activated sludge drawn from the clarifiers is returned to the biological process by a RAS/WAS pump station.

v. Disinfection

An ultraviolet (UV) disinfection system designed to handle the peak flow with one bank out of service provides disinfection.

vi. Post Aeration

Supplemental aeration follows the UV system and maintain a minimum dissolved oxygen concentration of 7.0 mg/l before discharge to Hinkston Creek. The aeration segment is provided with fine bubble diffusers. Peak oxygen demand of the post-aeration system is based on a peak flow of 10.0 mgd, peak DO deficit of 7 mg/l and wastewater temperature of 25^0C.

vii. Sludge Treatment

Waste activated sludge (WAS) drawn from the clarifiers is pumped to the sludge dewatering facilities for thickening using extended gravity belts and further dewater using belt filter presses. The biosolids cake is hauled to the landfill for disposal.

viii. Process Control

The plant has a laboratory equipped with necessary equipment and supplies to measure parameters for controlling all unit processes. Automatic, refrigerated samplers take continuous flow proportioned samples of the plant influent and effluent. Portable samplers are used for periodic sampling at intermediate points in the treatment process.

Wastewater flow through the main treatment process is metered by a Parshall flume located after post aeration prior to discharge. The influent pump station and RAS is metered with a mag-meter.

Other continuous monitoring functions include plant influent pH and plant effluent dissolved oxygen.

g. Effluent Requirements

A KPDES Permit for the Hinkston Creek wastewater treatment plant is included as Appendix b. A schematic of the existing facility can be seen in Exhibit 6-1.

D. Other Wastewater Systems in the Planning Area

1. Nestle Foods WWTP

Nestle Foods Operates an industrial pretreatment WWTP to reduce organic loading of their discharge prior to entering the MSWSS collection system.

E. Operation and Maintenance

The MSWSS operates and maintains the wastewater collection and treatment system. There is a regular maintenance program including daily checking and maintaining pump stations and other sewer line maintenance. Pump station wet wells are cleaned once a year. General cleaning and painting are done continuously. Sewer line repairs are done in response to problems noted from inspections. Treatment plant operators are responsible for all the necessary maintenance at the plant.

F. Compliance

The Hinkston Creek WWTP has been a reliable enhanced biological nutrient removal facility over the years with very few NOV's. Below are the few NOV's issued to the facility since 2016:

12/4/2019 – E. Coli @ 257 MPN/100 ml – This was due to UV lamp malfunction.
5/22/2019 – Ammonia @ 17.9 mg/l – This was due to a faulty D.O. sensor.
9/04/2018 – CBOD @ 422.33 lb/day – This was due to high rainfall.
12/04/2017 – E. Coli @ 996.53 mg/l – This was due to a UV lamp malfunction.
6/12/2017 – CBOD @ 813.40 lb/day - This was due to high rainfall.

EXHIBIT 6-1

Schematic of Hinkston Creek WWTP

Scale: NOT TO SCALE

Sheet: 6-1

EXHIBIT 6-1
HINKSTON CREEK WWTP SCHEMATIC
WASTEWATER FACILITIES PLAN
CITY OF MT. STERLING, KENTUCKY

Date:	10/10/2019
Drawn:	TEW
Checked:	DFS
Approved:	DFS

bell engineering

Section 7 Forecast Flows and Wasteloads in the Planning Area

SECTION 7
FORECAST FLOWS AND WASTELOADS IN THE PLANNING AREA

A. Purpose

The purpose of this section is to project flows and loadings for the identified planning area for the period of the year 2020 through 2040. These flow and loadings will be used to determine the capacity of the existing systems and to size future improvements to the treatment systems to ensure compliance with the KPDES permits for each treatment facility.

B. Existing Flows

1. Water Consumption

Water service is provided to the MSWSS and surrounding areas, including six water districts, by the municipally owned 4.3 mgd water treatment plant and distribution system. Some of the population served by the water districts is within the Mount Sterling city limits and is served by the MSWSS wastewater system.

2. Sewer Usage

Sewer service is provided by MSWSS to the City of Mount Sterling and the surrounding service area and treated at the 3.0 mgd Hinkston Creek WWTP. A summary of flows for a three-year period shows that the average daily flow to the WWTP has reached 2.53 mgd, which is 84 percent of the design capacity.

TABLE 7–1
HYDRAULIC LOADING

CHARACTERISTIC	DESIGN FLOW (1997-2000) (mgd)	AVERAGE DAILY FLOW (2015-2018) (mgd)	PERCENTAGE OF CAPACITY (%)
Effluent Flow	3.0	2.53	84

a. Commercial Contribution

The 2015 comprehensive plan estimated that there are approximately 250 acres of land for commercial use. Using 800 gallons per acre per day results in 0.2 mgd.

b. Industrial Contribution

According to the 2015 Comprehensive Plan there are 493 acres available in the current industrial park with 130 acres not readily developable, leaving 363 acres ready for development. Using 1,500 gallons per acre per day results in 0.545 mgd.

3. Determining Inflow and Infiltration

The purpose of this evaluation is to determine whether I/I into the MSWSS sewerage system is excessive. If I/I is determined to be excessive, it must further be determined whether it is more cost-effective to build treatment facilities and treat the entire flow or to eliminate some of the I/I from the system through sewer rehabilitation.

Wastewater flow can be divided into several components: residential, commercial, and industrial flows; and inflow and infiltration. Residential flow is contributed by households. Commercial flow is wastewater produced by businesses with restroom facilities and/or kitchens. Industrial flow is produced by businesses which manufacture a product. Inflow is that water which enters the system directly during rainfall events through such sources as roof and/or foundation drains, and storm drains. Infiltration is defined as water which enters the sewer system from the ground through such means as defective pipes, pipe joints, connections and manhole walls.

It is necessary to divide the components of the wastewater flow in order to determine whether the amount of water entering the sewerage system as inflow and infiltration (I/I) is excessive. The Kentucky Division of Water bases this determination on two criteria.

I/I is excessive if:

Average Day Domestic Flow + Infiltration > 120 gpcd

Maximum Day Domestic Flow + Infiltration + Inflow > 275 gpcd

A quick method to determine if I/I in gpcd is excessive is to take the average WWTP flow, subtract the commercial and industrial flow and divide that by the residential population. Based on the information presented in the previous tables, resulting in the following equation:

$$gpcd \equiv (WWTPFlow - Commercial - Industry) \div ResidentialPopulation$$

a. Hinkston Creek WWTP

The estimated residential population connected to the Hinkston Creek sewer system in 2020 is 14,970. When placed in the equation it gives the following per capita per day flow.

gpcd = (2.73 – 0.2 – 0.545) / Population
therefore gpcd = 132.59 (>120 gpcd)

This same equation is used to determine excessive I/I for wet weather flow using maximum daily wastewater flow. The highest recorded flow at the Hinkston Creek WWTP was 10.4 mgd.

gpcd = (10.0 – 0.2 – 0.545) / Population
therefor gpcd = 618.24 (>275 gpcd)

The preceding information indicates that I/I for the Hinkston Creek transportation system is considered excessive.

C. **Flow and Waste Load Forecasts**

1. Background Considerations and Methodology

Forecasts of wastewater loads for the planning area considers flows from the following sources:

a. Domestic or residential
b. Commercial
c. Industrial

Flow forecasts were made for the service planning area based upon the population which is expected to be served in 20 years. The domestic population flow is based on 100 gallons per capita per day. Future commercial and industrial flows are based on projected water usage and projected waste strength characteristics. The projected flows are used as the basis for design of the proposed wastewater treatment facilities.

2. Future Flows

The existing 2020 population of Mount Sterling served by wastewater collection and treatment facilities is 14,970 persons. By the end of the planning period in 2040, it is projected that 18,608 persons will be served by the existing sewage collection system.

TABLE 7-2
ESTIMATED FUTURE FLOW GENERATION

TYPE OF DEVELOPMENT	PER ACRE RATE
Residential Development	1,000 gallons/acre/day
Commercial	800 gallons/acre/day
Industrial	1,500 gallons/acre/day

d. Residential Flow Projections

Residential flow projections are based on the population projections provided in chapter 4 using an average residential flow per person of 100 gallons per capita per day. The projected flows are shown in table 7-2. The population of the planning area was used to calculate anticipated peak flows for future growth as these areas will be newer sewers.

To determine the peak-flow, the total flow (residential + commercial + industrial) was multiplied by the Ten States Standards peaking factor.

$$Flow_{peak} = (Flow_{average}) \times (Peaking\ Factor)$$

Peaking Factor = (18+Square Root (P))/((4+Square Root (P))
P = equivalent population in thousands

The planning area population for the census year 2020 was 14,970 resulting in an average and peak daily flow as follows:

ADF = 14,970 population x 100 gallons per capita = 1,497,000 gallons per day.

The peak flow for this period would then be calculated as follows:

$$\text{Peaking Factor (PF)} = \frac{18+\sqrt{14.97}}{4+\sqrt{14.97}} = 2.78$$

Peak Daily Flow (PDF) = ADF x PF = 1,497,000 x 2.78 = 4,161,660 gallons per day

TABLE 7-3
RESIDENTIAL WASTEWATER FLOW PROJECTION

YEAR	PLANNING AREA POPULATION	AVERAGE WASTEWATER FLOW (mgd)	PEAK WASTEWATER FLOW (mgd)
2020	14,970	1.497	4.491
2025	15,896	1.590	4.720
2030	16,817	1.682	5.046
2035	17,712	1.771	5.313
2040	**18,608**	**1.861**	**5.583**

e. Commercial Flow Projections

Commercial flows are based on the land use maps shown in Section 3. The total developed acreage in 2010 was approximately 325 acres according to the 2015 Comprehensive Plan and it was projected that the land needs would reach 400 acres by 2020. The average increase per year in additional commercial acreage needed is 10 acres per year or 100 acres every 10 years. The following table project commercial flows based on the commercial acreage land needs. Flow projections are based on 800 gallons per acre per day.

TABLE 7-4
COMMERCIAL WASTEWATER FLOW PROJECTION

YEAR	COMMERCIAL ACREAGE DEVELOPED	AVERAGE WASTEWATER FLOW (mgd)	PEAK WASTEWATER FLOW (mgd)
2020	400	0.320	0.960
2025	450	0.360	1.080
2030	500	0.400	1.200
2035	550	0.440	1.320
2040	**600**	**0.480**	**1.440**

f. Industrial Flow Projection

Industrial flows are generated based on the land use maps in Section 3. The total developed acreage in 2010 was approximately 732 acres according to the 2015 Comprehensive Plan. The following table projects Industrial flows based on the industrial acreage land needs. Flow projections for industrial growth are based on 1,500 gallons per acre per day.

TABLE 7-5
INDUSTRIAL WASTEWATER FLOW PROJECTION

YEAR	INDUSTRIAL ACREAGE DEVELOPED	AVERAGE WASTEWATER FLOW (mgd)	PEAK WASTEWATER FLOW (mgd)
2020	830	1.245	3.735
2025	880	1.320	3.960
2030	930	1.395	4.185
2035	980	1.470	4.410
2040	1,030	1.545	4.635

g. Combined Future Flows

TABLE 7-6
2040 COMBINED WASTEWATER FLOW PROJECTION

FLOW CONTRIBUTION	AVERAGE WASTEWATER FLOW (mgd)	PEAK WASTEWATER FLOW (mgd)
Residential	1.861	5.583
Commercial	0.480	1.440
Industrial	1.545	4.635
Industrial Reserve	1.000	3.000
Total	**4.886**	**14.655**

As mentioned in the 2015 Comprehensive Plan, "due to the regional role played by the City, its geographical location and 2 interchanges on I-64, and the recent development of major automotive assembly plants and their suppliers in Kentucky, it is conceivable that a major manufacturing and assembly concern needing 100-300 acres may elect to locate along the I-64 corridor." Major manufacturing could require 3,000 – 4,000 gpd/acre resulting in an additional flow of 0.3 – 1.2 mgd. The Mount Sterling Planning Commission and community leaders have expressed the need to allow for an additional 1.0 mgd of capacity at the Hinkston Creek WWTP to be reserved for future anticipated major manufacturing. In addition to residential, commercial and industrial growth, there will need to be additional capacity to serve existing homes currently on septic systems identified to be served over the next 20 years. Based on these growth projections, we would recommend the following design capacities:

2040 Design Average Daily Flow (ADF) = 6.0 mgd
2040 Design Peak Daily Flow (PDF) = 16.0 mgd

3. Future Waste Load Forecasts (2040)

a. General

Future waste loads are calculated based upon a population equivalent for all flows and applying recognized standards for engineering design to the equivalent population. The waste load allocation is calculated as follows:

NOTE: mgd = million gallons per day
gpcd = gallons per capita per day
#/day/capita = pounds per capita per day

Average Flows

Population Equivalent	**Hinkston Creek**
Domestic	2.756 mgd
Commercial	0.711 mgd
Industrial	2.533 mgd
Total Equivalent Population (Based on 100 gpcd)	60,000

b. BOD_5 Load Forecast

BOD_5 (Five Day Biochemical Oxygen Demand) is computed based on 10-State Standards recommendation for design (0.22 #/capita/day). The Hinkston Creek WWTP is heavily influenced by industrial contributions that are high strength waste streams. The average BOD_5 loading is around 300 mg/l.

Population Equivalent	**Typical WWTP**	**Hinkston Creek**
60,000 Persons	13,200 #/day	15,012 #/day

c. TSS Load Forecast

TSS (Total Suspended Solids) is computed based upon 10-State Standards recommendation for design (0.25 #/capita/day). The Hinkston Creek WWTP is heavily influenced by industrial contributions that are high strength waste streams. The average TSS loading is around 400 mg/l.

Population Equivalent	Typical WWTP	Hinkston Creek
60,000 Persons	15,000 #/day	20,016 #/day

d. NH_3N Load Forecast

NH_3N (Ammonia Nitrogen) load forecast is based upon Metcalf & Eddy recommendations for design (0.017 #/capita/day). The Hinkston Creek WWTP is heavily influenced by industrial contributions that are high strength waste streams. The average ammonia loading is around 25 mg/l.

Population Equivalent	Typical WWTP	Hinkston Creek
60,000 Persons	1,020 #/day	1,251 #/day

e. Summary of Loadings

TABLE 7-7
2040 WASTEWATER LOADING PROJECTION

CONSTITUENT	AVERAGE CONCENTRATION (MG/L)	LOADING (LBS/DAY)
BOD5	300	15,012
TSS	400	20,016
NH3N	25	1,251
TP	10	500

Section 8 Alternative Wastewater Systems

SECTION 8
ALTERNATIVE WASTEWATER SYSTEMS

A. Framework for Alternatives

1. Background and Purpose

Previous Sections of this document have described the existing wastewater system for the Mount Sterling planning area. The purpose of this Section is to establish objectives in addressing wastewater system needs and determine the alternative method best suited to meet these objectives.

2. Wastewater Treatment Objectives

The objectives are as follow:

Objective 1: Expand wastewater treatment plant capacity to accommodate existing and future flow requirements.

Objective 2: Meet Stream Quality Standards set forth by federal and state water quality policies.

Objective 3: Expand trunk line sewer system capacity to meet flow requirements anticipated in the next 20 years.

Objective 4: Eliminate the excessive inflow and infiltration (I/I) in the wastewater collection system.

3. Stream Quality Design Standards

The Environmental Protection Cabinet, State of Kentucky has the responsibility and authority to perform waste load allocations for the purpose of establishing discharge limits for permitted discharges to the surface waters of Kentucky. The State is also charged with the responsibility of issuing Kentucky Pollutant Discharge Elimination System (KPDES) permits to municipalities and industries that treat and discharge waste. A waste load allocation for Mount Sterling has been requested and received for one proposed discharge point at the existing Hinkston Creek WWTP.

TABLE 8-1
WWTP EFFLUENT REQUIREMENTS

PARAMETER	HINKSTON CREEK
$CBOD_5$	10.0 mg/L
Suspended Solids	30.0 mg/L
Dissolved Oxygen	7 mg/L
Ammonia Nitrogen	4 mg/l (5/1 – 10/31) 10 mg/l (11/1 – 4/30)
Total Phosphorus	1.0 mg/L
Reliability Classification	Grade C

4. Wastewater Treatment Processes

The existing WWTP located along Hinkston Pike in the northeast portion of Montgomery County was built in 2000 in accordance with the 2000 supplement to the 1997 Wastewater Facilities Plan. Nearly 20 years have passed since the treatment facility was constructed and the system has functioned as designed over that period. The facility was rated for 3.0 million gallons per day (mgd). Since that facility was constructed, the City has experienced growth and the current average daily flow is over 2.53 mgd which is approximately 84% of the rated capacity. A pre-planning meeting was conducted on May 15th, 2019 to discuss the potential for re-rating the existing facility and expanding the capacity. On June 13, 2019, a wasteload allocation was approved, establishing the design effluent limitations for a 6.0 mgd facility. While the facility has been well maintained, there are multiple mechanical components in the facility that have reached their useful life and will need to be replaced.

5. Wastewater Disposal Considerations

Discussion of recycle, reuse or land application of treated effluent was not pursued as part of this document. Recycling and reuse continue to be considered not cost-effective. Likewise, land application of treated effluent is considered not cost-effective. Surface discharge remains as the selected cost-effective wastewater disposal option.

6. Sludge Disposal

Advancements in technology and increased cost of labor as well as changes in regulations regarding land application have impacted the options available for sludge disposal. Therefore, the only cost-effective sludge disposal alternative addressed is on-site dewatering and transport to landfill for ultimate disposal.

B. Alternative Wastewater Treatment Systems

1. Site Selection Options

a. Expand the existing treatment system on existing site.

The existing Hinkston Creek WWTP site was originally designed to accommodate a wastewater treatment plant expansion from 3.0 mgd to 6.0 mgd. Below is a graphic showing the location of the potential future expansion.

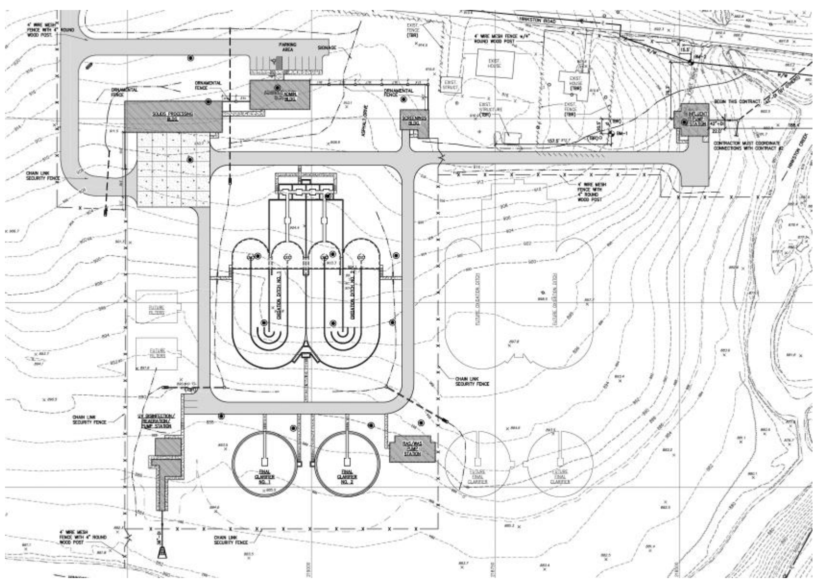

Figure 8-1 Site Plan

b. Locate alternate site for treatment plant expansion.

There is additional land on the opposite side of Hinkston Creek for a new WWTP. However, since land is available at the existing site, it would not be economical to build a new plant on another site. For this reason, a new site will no longer be considered.

C. Recycling and Reuse of Wastewater

Recycling and reuse of wastewater is not considered cost-effective and is not evaluated.

D. Wastewater Treatment Process Options - Hinkston Creek WWTP

1. Alternative Analysis

The basic treatment alternatives to be considered are as follows:

- Alternative # 1 - Oxidation Ditches (see Exhibit 8-6 thru 8-8)
- Alternative # 2 – Integrated Fixed Film Activated Sludge (see Exhibit 8-9 thru 8-11)
- Alternative # 3 - Regionalization
- Alternative # 4 - No Action

Included in each alternative evaluation is the cost of influent pumping, screening, RAS/WAS pumping, UV disinfection and upgrades to solids processing equipment.

Alternative # 1 – Oxidation Ditches

As described in previous sections of this report, the existing Hinkston Creek WWTP utilizes two (2) oxidation ditch enhanced biological nutrient removal (EBNR) systems and two (2) clarifiers for secondary treatment of wastewater. This alternative would add one (1) EBNR systems and one (1) additional clarifier to bring the rated capacity of the treatment system to 6 mgd ADF and 18 mgd PDF. Nutrient removal would be accomplished primarily by the EBNR process with backup metal salt chemical feed systems. The existing chemical feed system is sized to handle the additional flows.

This alternative could be easily implemented since the piping associated with these improvements and the grading has already been completed with the 2000 construction. The following improvements are associated with this alternative:

- One (1) new influent splitter box to divert flows to the new EBNR systems.
- Two (2) new influent pumps and controls to convey the additional flows to the headworks of the existing facility.
- One (1) additional screen.
- One (1) new EBNR systems (1.45 MG) including anaerobic selector basins, anoxic and oxic basins and appurtenances.
- One (1) new circular clarifier and appurtenances.
- One (1) new clarifier splitter box.
- Yard piping modifications.
- One (1) new UV System.
- Sludge modifications.

Alternative # 2 – Integrated Fixed-Film Activated Sludge

In order to gain additional capacity without constructing new EBNR basins, an Integrated Fixed-Film Activated Sludge Process (IFAS) will be considered as an alternative. Introduction of biomass carriers into an existing OD is a potential method of enhancing the treatment capacity of the system without increasing its footprint. The advantage of biomass carriers over activated sludge-based systems becomes more prominent especially at low temperatures when an increase in nitrification capacity is required. This approach, however, cannot be implemented in a straightforward manner due to the unique hydraulic patterns within the oxidation ditch. The concrete flow channels would need to be removed along with the vertical aerators. New diversion walls would be constructed along with aeration grids and blowers. A new curtain wall with screens would need to be constructed to prevent the suspended media from leaving the basin along with mixers to keep the media suspended.

- One (1) new influent splitter box to divert flows to the new EBNR systems.
- Two (2) new influent pumps and controls to convey the additional flows to the headworks of the existing facility.
- One (1) additional screen.
- Two (2) new IFAS reactor modifications to the existing oxidation ditches.
- One (1) new circular clarifier and appurtenances.
- One (1) new clarifier splitter box.
- Yard piping modifications.
- One (1) new UV System.
- Sludge modifications.

Alternative # 3 – Regionalization

Interconnecting the Mount Sterling sanitary sewer system into a regional facility with another community is not economically feasible at this time. Therefore, this alternative will no longer be considered.

Alternative # 4 - No Action

The third alternate – No Action, would not provide additional treatment capacity. If no action is taken, the treatment system will be overloaded and unable to treat future flows and loadings from the planning area. This would result in discharges from the treatment facility that exceed the discharge limits of the treatment system. These violations would result in enforcement action requiring the utility to provide a corrective action plan and prepare to spend funds that were not properly planned resulting in excessive rate increases to the customers. Therefore, this alternative will no longer be considered.

2. Monetary Costs (Present Worth Analysis)

Schematic of the proposed alternates can be seen in Exhibits 8-8 and 8-11. Detailed opinion of probable project costs for alternative # 1 and 2 can be seen in Exhibits 8-6 and 8-9. Below is a present worth table for each alternative.

TABLE 8-2
PRESENT WORTH

PARAMETER	ALTERNATIVE NO. 1	ALTERNATIVE NO. 2
Construction Costs	$10,000,000	$11,230,000
O&M Costs	$9,325,768	$11,378,022
Salvage Value	($594,152)	($569,720)
Present Worth	**$18,731,616**	**$22,038,302**

3. Non-Monetary Evaluation

Plan selection requires that we evaluate non-monetary impacts that each alternative will have on the environment and the community. The following categories of non-monetary evaluations will be discussed:

a. Operability

Alternative # 1 – Oxidation Ditches. The existing treatment system is based on oxidation ditch technology and the operators are very familiar with the operation of this system. Oxidation ditches operate with a long hydraulic retention time and complete mixing minimizes the impact of shock loads or hydraulic surges. They produce less waste activated sludge than other biological treatment processes because they operate under conditions similar to extended aeration systems with long sludge ages. These types of systems are well-suited for treating typical domestic waste, have moderate energy requirements, and work effectively under most types of weather.

Alternative # 2 – IFAS. The IFAS system is a fixed-film activate sludge treatment system that uses fixed-film bacteria along with free floating bacteria to reduce nutrient levels in the wastewater. This process is not as stable as the oxidation ditch type treatment process. It is sensitive to return sludge concentrations. The bacteria layer on the media can experience high growth and sluff-off causing mixed liquor concentrations to increase. This requires a higher level of operator control.

b. Reliability

The reliability of each treatment system is primarily related to the quality of the equipment used and the run time associated with individual components of each system. This will be a function of the design process to some degree. As long as the designers use quality equipment for each treatment process, the reliability will be similar for each system. The run time associated with each system and the type of equipment used can also affect the reliability.

Alternative # 1 – Oxidation Ditches. The existing system uses vertical aerators that consume a lot of power but are very reliable and have not experienced chronic failures. Oxidation ditches are very common in the municipal sewage treatment industry with a long history of reliable operation.

Alternative # 2 – IFAS. The IFAS treatment technology is relatively new and does not have a long track record of performance. However, the fine/medium bubble aeration systems and fixed-film treatment technology has a long history of reliability as well.

c. Environmental Impact

Each alternative will be designed to prevent effluent concentrations from violating KPDES limits associated with the facility.

1) Runoff Control

Runoff will be controlled by reducing the amount of land grading and clearing. The oxidation ditch process will require construction of one (1) new basins. However, this area has already been graded for this construction and it will require minimal land disturbance. The IFAS process will utilize the existing basins and not require any land grading other than yard piping installations.

2) Erosion Control

Each alternative will require erosion control. Slopes will be protected and buffer zones installed to protect the water ways from soil laden runoff. The IFAS alternative will require less land disturbance and thus will result in less chance for erosion.

3) Sediment Control

Temporary diversion dikes and silt fences will prevent sediment transport. Rock dams and sediment traps will be installed as needed to prevent runoff of sediment. Each alternative will require similar sediment controls.

4) Water Quality

Water quality structures will be installed prior to construction to prevent contamination of the waters of the commonwealth during construction. In addition, each alternative will be designed to prevent effluent concentrations from violating KPDES limits associated with the facility.

d. Constructability

The implementation of the oxidation ditch system will not require any part of the treatment system to be off-line during construction except for short period when piping connections are made. The IFAS system will require each existing oxidation ditch to be out of service for the period of time it will take to demolish the interior walls and construct the new equipment.

e. Public Perception

An informative meeting with concerned citizens will be conducted to inform the public of the plans for expansion of the wastewater systems and discuss the process alternatives considered in this report. Each treatment alternative will be designed to comply with effluent limits and should be perceived as equivalent processes from a water quality perspective.

2. Screening Matrix Evaluation

TABLE 8-3
SCREENING MATRIX

EVALUATION CRITERIA	WEIGHT FACTOR	AVERAGE RANK/AVERAGE SCORE	
		OXIDATION DITCH	IFAS
1. Present Worth	15	5/75	3/45
2. Operability	10	5/50	4/40
3. Reliability	10	5/50	4/40
4. Environmental Impact	10	5/50	5/50
5. Constructability	15	4/60	5/75
6. Public Perception	10	4/40	4/40
Total Score		**325**	**290**

Notes:
1. Average rank ranges from 1 to 5 with 5 being the most favorable rank.
4. Average score is the product of rank and the weight factor.
5. The alternative with the highest overall score represents the most favorable alternative.

3. Hinkston Creek WWTP Selected Alternative is the oxidation ditch.

E. Wastewater Collector and Trunk Sewer Systems

1. Collector Sewers

Details on collection sewers for future developments are beyond the scope of this plan, as it is presumed these would be installed by the owners/developers of the benefited property. The potential exists that some areas could develop prior to construction of the sewers proposed in this plan necessitating the construction of facilities with limited capacities to pump back into the existing system on an interim basis. Should interim facilities be required, they would either be incorporated into the plan or abandoned once the trunk facilities in this plan have been constructed. Therefore, limited capacity interim facilities should not be considered to be in conflict with this plan.

2. Outfall Sewers

There are approximately 72,400 linear feet of outfall sewers to new areas previously unserved in the planning area. (See Exhibits 8–1 through 8-5) The following is a brief description of each section of outfall sewers. The opinion of probable project costs are shown in the tables at the end of this Section.

a. Harpers Creek Outfall Sewers (Southwest Quadrant)

Approximately 2,800 linear feet of 10-inch outfall sewers are planned to serve this area. The sewers drain into Harpers Creek drainage area and are collected by the Harpers Creek pump station and conveyed to the Spencer Creek outfall sewers. This line is labeled O.S.1 on Exhibit 8-1.

b. Spencer Creek Outfall Sewers (Southwest Quadrant)

Approximately 7,200 linear feet of 12-inch, 7,000 linear feet of 10-inch and 9,000 linear feet of 8-inch outfall sewers are planned along Spencer Creek. The sewers drain into Harpers Creek drainage area and are collected by the Harpers Creek pump station and conveyed to the Spencer Creek outfall sewers.

c. Reid Village Outfall Sewers (Southeast Quadrant)

Approximately 6,000 linear feet of 10-inch and 15,000 linear feet of 8-inch outfall sewers are planned in the Reid Village Area. The sewers drain into Hinkston Creek drainage area.

d. Hinkston Creek Outfall Sewers (Southeast Quadrant)

Approximately 2,200 linear feet of 12-inch, 5,000 linear feet of 10-inch and 16,200 linear feet of 8-inch outfall sewers are planned along Hinkston Creek.

e. North Ridge and Grand Prairie Sewers (Northwest Quadrant)

Approximately 4,200 linear feet of 8-inch outfall sewers are planned in the North Ridge and Grand Prairie areas. The sewers drain into Somerset Creek drainage.

f. Fox Chase Sewers (Northeast Quadrant)

Approximately 2,200 linear feet of 8-inch outfall sewers are planned in the Fox Chase area.

3. Relief Sewers

Approximately 18,600 linear feet of the new sewers are relief sewers which will eliminate existing pump stations. The following is a list of each pump station that will be eliminated with the installation of that relief sewer.

a. Brent Heights P.S. - 4,800 l.f. of 10-inch relief sewer (R.S. 1).
b. Eastland P.S. - 5,000 l.f. of 12-inch relief sewer (R.S. 2).
c. Smith Street P.S. - 1,000 l.f. of 8-inch relief sewer (R.S. 3)
d. Alliance Drive P.S. - 3,200 l.f. of 10-inch relief sewer (R.S. 4).
e. The Autumn Ridge P.S. -4,600 l.f. of 10-inch relief sewer (R.S. 5).

4. Pump Station and Force Mains

a. Harpers Creek Pump Station and Force Main

The Harpers Creek 500 gpm pump station and 8-lnch force main will provide wastewater facilities to the Osborne Road area outside the bypass. This pump station and force main are labeled as P.S. 1 and F.M. 1.

b. Spencer Creek Pump Station and Force Main

The Spencer Creek 750 gpm pump station and 10-inch force main will provide wastewater facilities to the Spencer Creek area. This pump station and force main are labeled as P.S. 2 and F.M. 2.

F. Proposed Collection System Improvements

1. Southeast Quadrant

a. Harpers Creek Relief/Outfall Sewers, Pump Station, and Force Main

Approximately 7,600 linear feet of 10-inch of outfall sewers serve this area. The sewers drain into the Harpers Creek drainage area and are served by the Harpers Creek Pump Station.

TABLE 8-4
HARPERS CREEK OUTFALL SEWER (11-20 Year)

SEGMENT	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	ESTIMATED COST
R.S. 1	10- inch Sewer	4,800	L.F.	$75	$360,000
	Standard Manholes	20	Each	$4,000	$80,000
O.S. 1	10 – Inch Sewer	2,800	L.F.	$75	$210,000
	Standard Manholes	11	Each	$4,000	$44,000
P.S. 1	500 gpm Harpers Creek Pump Sta.	1	Each	$350,000	$350,000
F.M. 1	8 – Force Main	5,000	L.F.	$55	$275,000
Sub-Total					$1,319,000
Construction Contingency @ 10%					$132,000
Sub-Total – Estimated Construction Costs					$1,451,000
Project Development Costs @ 25%					$363,000
Total – Estimated Project Cost					***$1,814,000***

Notes: All numbers rounded to the nearest $1,000

b. Spencer Creek Outfall Sewer

Approximately 9,000 linear feet of 8-inch, 7,000 linear feet of 10- inch and 7,200 linear feet of 12-inch outfall sewers are planned along Spencer Creek. These lines are labeled as O.S. 2 through O.S. 7.

TABLE 8-5
SPENCER CREEK OUTFALL SEWER (11-20 Year)

SEGMENT	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	ESTIMATED COST
R.S. 2	12– Inch Sewer	5,000	L.F.	$85	$425,000
	Standard Manholes	11	Each	$4,000	$44,000
R.S. 3	8– Inch Sewer	1,000	L.F.	$65	$65,000
	Standard Manholes	4	Each	$4,000	$16,000
O.S. 2	12- Inch Sewer	5,000	L.F.	$85	$425,000
	Standard Manholes	20	Each	$4,000	$80,000
	Hwy. 713 Bore & Case	100	L.F.	$370	$37,000
O.S. 3	12- Inch Sewer	2,200	L.F.	$85	$187,000
	10- Inch Sewer	2,600	L.F.	$75	$195,000
	8- Inch Sewer	1,000	L.F.	$65	$65,000
	Standard Manholes	11	Each	$4,000	$44,000
	Hwy. 686 (Bypass) Bore & Case	100	L.F.	$370	$37,000
O.S. 4	10-Inch Sewer	4,400	L.F.	$75	$330,000
	8-Inch Sewer	1,800	L.F.	$65	$117,000
	Standard Manholes	25	Each	$4,000	$100,000
O.S. 5	8-Inch Sewer	2,400	L.F.	$65	$156,000
	Standard Manholes	10	Each	$4,000	$40,000
	Hwy. 686 (Bypass) Bore & Case	100	L.F.	$370	$37,000
O.S. 6	8-Inch Sewer	1,800	L.F.	$65	$117,000
	Standard Manholes	7	Each	$4,000	$28,000
	Hwy. 686 (Bypass) Bore & Case	100	L.F.	$370	$37,000
O.S. 7	8-Inch Sewer	2,000	L.F.	$65	$130,000
	Standard Manholes	8	Each	$4,000	$32,000
P.S. 2	750 gpm Spencer Creek Pump Sta.	1	Each	$450,000	$450,000
F.M. 2	10 – Force Main	9,000	L.F.	$65	$585,000
Sub-Total					$3,779,000
Construction Contingency @ 10%					$378,000
Sub-Total – Estimated Construction Costs					$4,157,000
Project Development Costs @ 25%					$1,039,000
Total – Estimated Project Cost					***$5,196,000***

Notes: All numbers rounded to the nearest $1,000

2. Southwest Quadrant

a. Outfall Sewer to Hinkston Creek Trunk Sewers

Approximately 15,950 linear feet of 8-inch, 5,000 linear feet of 10-inch and 2,250 linear feet of 12-Lnch outfall sewers are planned to serve future development in the South West section of the planning area. These lines are labeled as O.S. 8 through O.S. 12.

TABLE 8-6
OUTFALL SEWER TO HINKSTON CREEK TRUNK SEWERS (11-20 YEAR)

SEGMENT	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	ESTIMATED COST
O.S. 8	8 – Inch Sewer	8,400	L.F.	$65	$546,000
	Standard Manholes	30	Each	$4,000	$120,000
O.S. 9	12- Inch Sewer	2,200	L.F.	$85	$187,000
	10- Inch Sewer	5,000	L.F.	$75	$375,000
	8- Inch Sewer	2,600	L.F.	$65	$169,000
	Standard Manholes	40	Each	$4,000	$160,000
O.S. 10	8 - Inch Sewer	2,000	L.F.	$65	$130,000
	Standard Manholes	8	Each	$4,000	$32,000
O.S. 11	8 -Inch Sewer	1,000	L.F.	$65	$65,000
	Standard Manholes	4	Each	$4,000	$16,000
O.S. 12	8 -Inch Sewer	2,200	L.F.	$65	$143,000
	Standard Manholes	9	Each	$4,000	$36,000
Sub-Total					$1,979,000
Construction Contingency @ 10%					$198,000
Sub-Total – Estimated Construction Costs					$2,177,000
Project Development Costs @ 25%					$544,000
Total – Estimated Project Cost					***$2,721,000***

Notes: All numbers rounded to the nearest $1,000

b. Outfall Sewers to Reid Village and Autumn Ridge Area

Approximately 7,600 linear feet of 8-inch and approximately 5,600 linear feet of 10-inch outfall sewers are planned in the Reid Village Area. These outfall sewers will serve unsewered areas south of U.S. 60 near Reid Village, and are labeled O.S. 13 through O.S. 17.

TABLE 8-7
OUTFALL SEWER TO REID VILLAGE (3-10 YEAR)

SEGMENT	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	ESTIMATED COST
R.S. 4	10– Inch Sewer	3,200	L.F.	$75	$240,000
	Standard Manholes	7	Each	$4,000	$28,000
R.S. 5	8 – Inch Sewer	4,600	L.F.	$65	$299,000
	Standard Manholes	11	Each	$4,000	$44,000
O.S. 13	8 - Inch Sewer	2,200	L.F.	$65	$143,000
	Standard Manholes	8	Each	$4,000	$32,000
	U.S. 60 Bore & Case	100	L.F.	$370	$37,000
O.S. 14	8 - Inch Sewer	2,400	L.F.	$65	$156,000
	Standard Manholes	9	Each	$4,000	$36,000
O.S. 15	10 -Inch Sewer	2,800	L.F.	$75	$210,000
	8 -Inch Sewer	2,800	L.F.	$65	$182,000
	Standard Manholes	7	Each	$4,000	$28,000
O.S. 16	8 -Inch Sewer	1,000	L.F.	$65	$65,000
	Standard Manholes	2	Each	$4,000	$8,000
O.S. 17	8 -Inch Sewer	2,000	L.F.	$65	$130,000
	Standard Manholes	5	Each	$4,000	$20,000
Sub-Total					$1,468,000
Construction Contingency @ 10%					$147,000
Sub-Total – Estimated Construction Costs					$1,615,000
Project Development Costs @ 25%					$404,000
Total – Estimated Project Cost					***$2,819,000***

Notes: All numbers rounded to the nearest $1,000

TABLE 8-8
AUTUMN RIDGE SEWERS (3-10 Year)

SEGMENT	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	ESTIMATED COST
O.S. 18	8 – Inch Sewer	1,800	L.F.	$65	$117,000
	Standard Manholes	4	Each	$4,000	$16,000
O.S. 19	8 - Inch Sewer	1,600	L.F.	$65	$104,000
	Standard Manholes	3	Each	$4,000	$12,000
P.S. 3	80 gpm Pump Sta.	1	Each	$200,000	$250,000
F.M. 3	4 – Force Main	5,800	L.F.	$35	$261,000
Sub-Total					$760,000
Construction Contingency @ 10%					$76,000
Sub-Total – Estimated Construction Costs					$836,000
Project Development Costs @ 25%					$209,000
Total – Estimated Project Cost					**$1,045,000**

Notes: All numbers rounded to the nearest $1,000

3. Northwest Quadrant

TABLE 8-9
NORTH RIDGE/GRAND PRARIE SEWERS (3-10 YEAR)

SEGMENT	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	ESTIMATED COST
O.S. 21	8 – Inch Sewer	2,400	L.F.	$65	$156,000
	Standard Manholes	6	Each	$4,000	$24,000
O.S. 22	8 - Inch Sewer	1,800	L.F.	$65	$117,000
	Standard Manholes	6	Each	$4,000	$24,000
P.S. 4	120 gpm Pump Sta.	1	Each	$250,000	$250,000
F.M. 4	6 – Force Main	5,300	L.F.	$45	$239,000
P.S. 5	120 gpm Pump Sta.	1	Each	$250,000	$250,000
F.M. 5	6 – Force Main	1,600	L.F.	$45	$72,000
Sub-Total					$643,000
Construction Contingency @ 10%					$64,000
Sub-Total – Estimated Construction Costs					$707,000
Project Development Costs @ 25%					$177,000
Total – Estimated Project Cost					**$884,000**

Notes: All numbers rounded to the nearest $1,000

4. Northeast Quadrant

TABLE 8-10
FOX CHASE SEWERS (3-10 YEAR)

SEGMENT	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	ESTIMATED COST
O.S. 23	8 - Inch Sewer	2,200	L.F.	$65	$143,000
	Standard Manholes	4	Each	$4,000	$16,000
P.S. 6	80 gpm Pump Sta.	1	Each	$200,000	$200,000
F.M. 6	4 – Force Main	8,000	L.F.	$35	$280,000
Sub-Total					$639,000
Construction Contingency @ 10%					$64,000
Sub-Total – Estimated Construction Costs					$703,000
Project Development Costs @ 25%					$176,000
Total – Estimated Project Cost					**$879,000**

Notes: All numbers rounded to the nearest $1,000

G. Sewer System Rehabilitation

The existing wastewater collection system has adequate capacity to convey the projected future average daily flows for the 0-2 year improvements identified in this facilities plan. However, from Section 7, it is concluded that inflow/infiltration (I/I) to the Hinkston Creek WWTP is excessive. Since the last upgrade of the treatment facility the plant has been successful in meeting their effluent limits at all points. Mount Sterling is pro-active in the management of the City wastewater facilities and this performance emphasizes that MSWSS acts expediently to implement cost-effective enhancements to the system, including I/I control.

1. Sanitary Sewer Rehabilitation Program

To pinpoint where excessive, I/I exist, the MSWSS has developed a Sanitary Sewer Rehabilitation Program. Flow monitoring will be conducted on each sewershed to identify high I/I locations. The rehabilitation program includes the following phases:

a. Phase 1 – Perform Flow monitoring in all I/I sewer sheds.
b. Phase 2 – Identify and rank sewer sheds based on I/I levels.
c. Phase 3 – Perform a physical survey of manholes in sewer shed #1.
d. Phase 4 – Perform a physical survey of pumping stations in sewer shed # 1.
e. Phase 5 – Hydraulic jet and mechanical cleaning of known high I/I areas.
f. Phase 6 – TV Inspection
g. Phase 7 – Identify rehabilitation projects.
h. Phase 8 – Perform rehabilitation work.
i. Phase 9 – Move to the next highest I/I sewer shed and repeat until all sewer sheds have been rehabilitated.

To expedite this process, the MSWSS will budget up to $250,000 over 10 - year to fund the rehabilitation program.

2. Funding

MSWSS was issued a KIA Fund A Loan in the amount of $13,202,540 in 2000 for the construction of the Hinkston Creek WWTP. The loan carries a 1% interest for 20 years. Payments against the loan began in 2003 and final payment will be due in June 2024. This will free-up funds to be applied against the new construction loan to increase capacity at the Hinkston Creek WWTP. The projects listed in the 0-2-year phase of this facilities plan will be funded by a new KIA Fund A loan up to $12,500,000. A short-term KIA Fund A design loan (KIA# A20-007) in the amount of $525,000 was approved by the KIA Board on June 5, 2019. This loan will be rolled into the construction loan after the project has been bid and awarded to the successful low bidder. Since the original loan from 2003 will be paid off prior to issuance of the new construction loan and the revenue obligated to the existing loan will be directed to pay off the new construction loan, no rate increase will be required. The time frames indicated for construction past the initial 0-2 year time frame are estimated based on projected growth. If the community does not see this expected growth, some or all of these projects could get pushed beyond the time frames indicated.

H. Selected Alternative Opinion of Probable Project Costs

TABLE 8-11
PROBABLE ESTIMATES OF PROJECT COSTS FOR PHASED IMPROVEMENTS

DESCRIPTION	0-2 YEARS	3-10 YEARS	11-20 YEARS
1. Wastewater Treatment Plants **a. Hinkston Creek**	**$12,320,000**		
2. Southeast Quadrant Sewers			
Harpers Creek Outfall Sewer			$1,814,000
Spencer Creek Outfall Sewer			$5,196,000
Sub-Total Southeast Quadrant	**$12,320,000**	**$0**	**$7,010,000**
3. Southwest Quadrant Sewers			
Outfall Sewer to Hinkston Creek Trunk			$2,721,000
Reid Village Sewers		$2,819,000	
Autumn Ridge Sewers		$1,045,000	
Sub-Total Southwest Quadrant Sewers	**$0**	**$3,864,000**	**$2,721,000**
4. Northwest Quadrant Sewers			
North Ridge/ Grand Prairie Sewers		$884,000	
Sub-Total Southwest Quadrant Sewers	**$0**	**$884,000**	**$0**
5. Northwest Quadrant Sewers			
Fox Chase Sewers		$879,000	
Sub-Total Southwest Quadrant Sewers	**$0**	**$879,000**	**$0**
6. Sanitary Sewer System Rehabilitation	**$180,000**	**$250,000**	**$250,000**
TOTALS	**$ 12,500,000**	**$ 5,877,000**	**$ 9,981,000**